



# ANALYSIS OF MANAGEMENT ALTERNATIVES AND THEIR IMPACTS

## BACKGROUND

In January 2002, a range of alternatives for management of different aspects of the Northern Highland-American Legion State Forest was presented to the public in Progress Report #10. They included recreation, land management, wild resources, and boundary expansions. The alternatives were based on the property's designation as a state forest, the draft vision and goals, the best available information acquired through inventories, assessments, monitoring and research, public input, and tribal consultation.

The four Recreation Alternatives covered a range of potential management options for recreation, spanning from an emphasis on primitive non-motorized recreation on one end of the range (less developed than now) to a substantial increase in developed facilities and motorized recreation over present levels.

The six Land Management Alternatives presented a range of options from an emphasis on early successional forests (i.e., aspen and birch), to an emphasis on older red and white pine, to an emphasis on passively managed forests and old-growth opportunities. Again, these forest management alternatives examine possible forest management directions within the capability of the state forest's landscape.

The five Wild Resources Alternatives examined the potential size and locations of areas on the forest that potentially could be designated as wild resource areas. These are areas for remote, non-motorized recreation where natural ecological processes dominate and evidence of human impact is low.

The Boundary Expansion Alternative examines several proposed key expansions as well as the "no action" alternative.

Progress Report 10 (January 2002) describes and maps each alternative.

Extensive inventories and studies of the NH-AL's resources were conducted prior to master planning. This included an assessment of the opportunities existing to protect and restore significant biological resources, with special attention to old growth forest opportunities (These assessments are discussed in more detail in Chapter 3 of the proposed plan). Each of the land management alternatives reflects a different degree of focused management of these sites. Table 2.1, Community Restoration and Old Growth Assessment (CROG) and Biotic Inventory sites incorporated in each Land Management Alternative, compares the designated CROG and Biotic Inventory sites incorporated into each. The Biotic Inventory Macrosites are not included in the chart totals.



## LAND MANAGEMENT ALTERNATIVES AND THEIR IMPACTS

Land Management Alternatives 1 through 6 present a gradient of land management options on the NH-AL.

Alternative 1 would emphasize early successional forests. Alternative 1 has the highest intensity of management, while Alternative 6 has the lowest intensity of management. Alternative 3 would emphasize longer-lived species (pines and hardwoods), with a variety of young and old forest communities across the NH-AL. Alternative 5 would have the greatest emphasis on older pines and hardwoods. In Alternative 6, just over 1/3 of the NH-AL would be managed in Wild Resources Areas without active management. Each of the six Land Management Alternatives is summarized below.

**Alternative 1:** Management for a range of natural communities and forest age classes with *emphasis on early successional forests dominated by aspen and white birch, and younger forests of red oak, red pine, and white pine.* Areas with the best opportunity for producing old growth pine, northern hardwood, and hemlock-hardwood would be managed for an old growth condition.

**Alternative 2:** Management for a range of natural communities and forest age classes with *emphasis on a forest dominated by older red and white pine with aspen, white birch, and red oak as important secondary species.* Areas with the best opportunity for producing old growth pine, northern hardwood, and hemlock-hardwood would be managed for an old growth condition. A greater emphasis on older northern hardwood forests is proposed compared to Alternative 1.

**Alternative 3:** Management for a range of natural communities and forest age classes with *emphasis on developing a wide range of natural conditions.* The forest would be dominated by older red and white pine with aspen, white birch, and red oak as important secondary species. Areas with the *best or very good opportunity* for producing old growth pine, northern hardwood, hemlock-hardwood, and red oak would be managed for an old growth condition. A greater emphasis on older northern hardwood forests with less aspen, pine, and red oak is proposed as compared to Alternatives 1-2.

**Alternative 4:** Management for a range of natural communities and forest age classes with *emphasis on a forest dominated by older red and white pine, with older white birch, aspen, and red oak as secondary species of declining importance.* The percent of young forest age classes would be reduced from Alternatives 1-3 with older ages emphasized across most forest types. Areas with *good, very good, or*



best opportunity for producing old growth pine, northern hardwood, hemlock-hardwood, and red oak would be managed for an old growth condition. A greater emphasis on older northern hardwood forests with less aspen, pine, and red oak is proposed as compared to Alternatives 1-3.

**Alternative 5:** Management for a range of natural communities and forest age classes with *emphasis on a forest dominated by older red and white pine, with older white birch, aspen, and red oak as secondary species of declining importance*. The percent of early successional habitat would be reduced from Alternatives 1-4 with older ages emphasized across most forest types. All areas with *moderate, good, very good, or best opportunity* for producing old growth pine, northern hardwood, hemlock-hardwood, and red oak would be managed for an old growth condition. Most northern hardwood and hemlock-hardwood old growth sites would be passively managed for an old growth condition. *No areas would have management specifically for aspen/white birch.*

**Alternative 6:** This alternative is the combination of Land Management Alternative 5 and Wild Resources Alternative V. This alternative represents the lowest level of management and development and it would provide the highest level of passively managed forest and primitive style recreational opportunities. Approximately 36% of the forest would have no active management with the primary goal being a landscape where there is little evidence of human impact as opposed to managing for a specific natural community. On the remainder of the property, the management will be as described in Alternative 5.

*NOTE: The analysis of Alternative 6 in this section represents the maximum impact on land management, both positive and negative, from the potential designation of*

*wild resources areas on the NH-AL. The impacts from the other Wild Resource Alternatives, Alternatives I – III, would be proportionally less.*

## IMPACTS TO PHYSICAL AND BIOLOGICAL RESOURCES

### SOILS

**Soil loss:** For all the land management alternatives the probability of significant impacts due to soil erosion is low. The potential for soil loss impacts from timber management activities on the NH-AL is low for several reasons. First are the sandy soils—95 percent of the forest soils are sandy, which have a fast infiltration rate. Water run-off rates are very low. On the sandy loam and silty loam soil areas (e.g., the Winegar Moraine) the potential for soil erosion due to management activities, particularly on steeper slopes, is slightly higher. However, additional precautions to control erosion impacts are designed into timber sale contracts on these sites. Second is the relatively low percentage of the forest land that is disturbed by forest management activities at any given time. Less than half of one percent of the forest is projected to be disturbed by timber harvesting and related activities in any year for the most intensively managed alternative, alternative one. Under current management only about 1 to 1.5 percent of the forest is harvested per year. Third, any potential soil erosion impacts to water bodies are further reduced by requiring all forest management adhere to Wisconsin's Forestry Best Management Practices for Water Quality (WDNR 1995). Poorly located and constructed forest roads are the largest source of pollution from forest management activities. Siting and construction standards for new forest roads and water crossings, as well as skid trails, logging landings are covered by the BMP requirements.

**Table 2.1 Community Restoration and Old Growth Assessment (CROG) and Biotic Inventory sites**

	Alternatives 1 and 2	Alternative 3	Alternative 4	Alternatives 5 and 6
<b>CROG</b>	A sites	A and AB sites	A, AB, and B sites	A, AB, B, BC, and C sites
<b>Biotic Inventory<sup>1</sup></b>	High-High sites	High-High and Medium-Medium sites	High-High, Medium-Medium and Medium-Low sites	High-High, Medium-Medium, Medium-Low and Low-Low sites
<b>Total Acreages</b>	48,170	60,660	68,160	74,600

Note: 1) The ranking of old growth opportunities for the CROG table comes from the Community Restoration and Old Growth Assessment (CROG). (Eckstein et al. 2001).

2) In the Draft Master Plan, 3,680 acres of unforested wetland sites that are included in many of the Alternatives were excluded from the list because unforested wetlands would be protected across the NH-AL regardless of designation.

<sup>1</sup> Table 2.1 corrects an error in Progress Report 10, NH-AL Alternatives, which included High-Medium sites. The Biotic Inventory did not use the High-Medium designation.

**Impacts to Forest Productivity:** Whole-tree harvesting has the potential to reduce long-term forest productivity. In a whole-tree harvest the whole tree is removed, while other harvests typically leave small branches, twigs, and leaves to decompose on-site. A recent study on long term soil productivity found that whole tree harvesting of aspen on loamy and clay soils had no negative effects on 5-year growth and productivity; but whole tree harvesting of aspen on sandy soils, such as found on the NH-AL, reduced 5-year aspen growth and productivity. (WDNR Silviculture and Forest Aesthetics Handbook: Aspen Chapter, Stone et al. 1999, Stone and Elioff 1998, Stone 2001) Another study found that whole tree harvesting had no significant effect on soil nutrition levels 5 years after harvesting (Alban and Perala 1990). However, this study used sandy loam soils rather than sandy or loamy sand soils.

Currently, some whole-tree harvests occur on the NH-AL, but the percent of whole tree harvests on the NH-AL is small compared to the percent of harvests that retain slash on site. The Land Management aspects of the Alternatives and Draft Master Plan are all expected to have minimal impacts on the productivity of the NH-AL, although whole tree harvesting of aspen on sandy soils may lead to a decrease in long term soil productivity over time on some sites.

## **WATER RESOURCES AND WETLANDS**

**Lakes and streams:** Under all alternatives the proposed land management activities would have no significant impacts on the quality of the lakes and streams, the hydrology or aquatic species. The primary sources of impact on water resources would be soil erosion from timber harvesting activities and related road building. Management activities such as road building, clearcutting and scarification, may result in very localized, limited short-term impacts to water quality due to increased run-off. However, as discussed under soil impacts, with the NH-AL's highly sandy soils and the requirement to follow the Best Management Practices for Water Quality (WDNR 1995) when performing timber harvesting activities, the potential for a significant impact on NH-AL waters is small.

The hydrology (i.e. rate of water recharge to lakes and streams) of the area would remain unchanged under all alternatives due to the predominance of high infiltration rates of the sandy soils and high percentage of the forest cover that is continuously retained.

**Unforested wetlands:** The six Land Management Alternatives propose mostly passive management in unforested wetlands and allow only temporary access across frozen wetlands. Where exotic invasive species such as purple loosestrife are effecting wetlands, they may be controlled through manual techniques, biological techniques, application of chemical

herbicides, or prescribed fire. Direct impacts to unforested wetlands from land management are generally expected to be positive, with management in wetlands (i.e., control of invasive species) occurring to preserve habitat quality and wetland function. In a small number of cases, unforested wetlands may be crossed by timber harvesting equipment under frozen conditions. In these cases, there may be localized impacts to wetland vegetation.

**Forested wetlands:** The six land management alternatives discuss only two different forested wetland management scenarios—managed and unmanaged. Under the management alternative some forested wetlands with older black spruce or other species would be harvested to maintain the forest community type and provide forest products. Timber harvesting in forested wetlands has the potential to reduce water levels, increased mortality of understory plants, negatively impact rare plants and special-concern bird species living there. See Chapter 1 for a more detailed discussion of the potential impacts of harvesting on forested wetlands.

The alternative of not harvesting forested wetlands is not without potential negative long-term impacts either. Trees in some types of forested wetlands tend to be very slow growing. In some situations, such as under poor seed conditions, drought, or heavy rainfall, forested wetlands may not regenerate. In pre-European settlement forests, fire was a significant disturbance factor and regeneration vehicle in wetlands as well as uplands (Eckstein et al. 2001). Without disturbances in wetlands over the next 100 years, some unforested wetlands may succeed to tamarack, and some tamarack could succeed to black spruce. This would also reduce the habitat and numbers of some wildlife species. However, succession and regeneration in forested wetlands is slow, uncertain, and depends on a variety of factors including water hydrology and water chemistry.

## **UPLAND VEGETATION AND HABITATS**

The forests of the NH-AL are a complex mosaic of many forest community types, ages, and structures because of varied soil, topography, and the history of previous use and management. The NH-AL's upland forests are a highly dynamic system. Their current composition reflects the strong influences of the land and historical actions. Dramatic changes in the forest and habitat have occurred over the last 100 years as the forest, guided by management and natural forces, rebounds from the late 1800s and early 1900s. First, pioneer tree species, especially aspen and white birch, became reestablished with some oak and planted pine. They prepared conditions for white and red pine and northern hardwoods to become established forest components. Gradually the forest is returning to a mix and balance of tree species and age classes more closely resembling the original forest on these sites.

The natural dynamic of the forest, which continues today, is well illustrated by the changes in aspen on the NH-AL over the last century. Prior to the cut-over in the late 1800s and early 1900s white and red pine was dominant across much of the NH-AL's landscape and aspen was a relatively small component of the forest. Aspen is found in nearly pure stands, in stands where it is the dominant species, and also as a common secondary component of many other timber types, including pine. As the forest became reestablished following the cut-over, aspen—a short-lived pioneer tree species—increased dramatically and became the dominant timber type. Aspen has slowly declined over the last 50 years as the post cut-over aspen stands aged and other species gradually returned, creating more mixed forest stands and habitats. These changes are continuing naturally today. Typically the species mix is white and red pine with aspen, white birch, oak, and northern hardwood species being strong components. These various forest types provide habitat for diverse plant and animal species.

About 75% of the NH-AL is upland. Each forest stand is classified and labeled by its dominant cover type. Most stands, however, contain a mixture of various tree species. Stands with the same dominant cover type may differ greatly. As of 2004 the total NH-AL acreage was dominated by aspen (34%), with fewer stands dominated by red and white pine (12%), red oak (8%), northern hardwoods (8%), white birch (5%), jack pine (3%), hemlock-hardwoods (2%), and other (3%).

All the NH-AL upland forest management alternatives recognize these natural forces at work and that the natural balance for much of the NH-AL's upland forest habitat is primarily a mix of species.

The six upland forest management alternatives considered vary from one another by the relative abundance and age classes of different timber types. The intensity of management (i.e., the scale and visibility of forest management activities) also varies across the range of alternatives.

**Impact on Forest Composition:** The *Master Plan Progress Report Number 10 – NH-AL Alternatives* provides additional details of the future forest composition by timber type (e.g., red and white pine, aspen/white birch, hemlock-hardwoods) under each land management alternative.

Of all the alternatives, Alternative 1 would have the highest level of aspen, white birch, and red oak along with younger stands of red oak, red pine, and white pine. Present aspen and white birch levels would be maintained or increased, halting their rapid decline. The level of northern hardwoods would decline. Likewise, this alternative would have the lowest level of old growth forest, focusing only on the best quality sites. There would be fewer larger, older red pine, white pine, red oak, and northern hardwood trees than would exist under

current management because the 1970s Big Tree Silviculture policy would be dropped.

Alternative One would have the most intensive management activity. The overall forest acreage annually harvested would moderately increase over present levels, but harvests would be larger and more complete than presently occur or would occur under all other Alternatives. Clearcut harvests and pine plantations would also become more common than today and would be the most prevalent of all the alternatives. In the near-term (next 20-30 years) aspen harvest levels would be similar to current levels, but the harvest of large pines and hardwoods would increase. After this, aspen harvest levels would increase moderately over present levels.

Alternative 6 represents the opposite end of the forest composition range. This alternative has the *oldest* forest with the lowest level of active management and the *oldest* forest. Overall, the percent of northern hardwoods and older pine is the highest of all the alternatives, and the amount of aspen, white birch, and oak is the lowest.

Management intensity would be the lowest of all the alternatives as approximately 36 percent (80,350 acres) of the forest would have no active management (passive management). On upland sites within this area the present forest cover would grow old, die, and succeed naturally over the long-term (50–100 years) from more sun- and disturbance-dependent forest types (aspen/birch, red pine, red oak, and jack pine) toward more northern hardwoods with white pine. Current red and white pine stands within the passively managed area over time would lose much of the shade-intolerant red pine component to more shade-tolerant species like red maple. Due to fire suppression and high white-tailed deer densities across the landscape, the passively managed Wild Resources Areas may succeed to balsam fir or sandy soil shade-tolerant northern hardwoods, such as red maple. Successional patterns will vary depending on site characteristics. In the long term, forest fragmentation would decrease in Wild Resources Areas, and these areas would provide a landscape with larger patch sizes dominated by ecological processes. Under Alternative 6, about 64% of the property would fall outside the Wild Resources Areas.

Northern hardwood dominated sites in the passive management areas over time would gradually shift in composition with the red and white pine, aspen, white birch and red oak, giving way to more shade-tolerant sugar maple, red maple, basswood, and yellow birch. The average age of the trees would also increase dramatically over time. Natural disturbances such as wind, fire and insects, and disease may occur to set back succession and provide regeneration of aspen/birch, oak, and some red/white pine in scattered locations.

Under Alternative 6 active forest management would occur on upland sites on the 64% of the State Forest. As in Alternative 5, red and white pine on the actively managed sites would slowly increase their dominance, reducing the level of aspen/birch, red oak, and jack pine. Also as in Alternative 5, the northern hardwood forest type would not be managed to maintain species diversity within stands. The result is that over time the level of red maple, sugar maple, and basswood, more shade-tolerant trees, would increase. The level of red oak, white birch, and aspen mixed within the northern hardwood stands would decrease. In areas now dominated by red and white pine the northern hardwood species, as secondary species, would likely increase. Alternative 6 (as does Alternative 5) maximizes the level of management for hemlock-hardwoods. The levels of red oak would generally decline over 50–100 years, however, it would remain a secondary species on sites with higher levels of disturbance from management or natural forces.

Under Alternative 6, including both the passively and actively managed areas, current levels of aspen dominated stands (33%) would continue to decrease to about 23% of the forest over the next 50 years and then down to about 10% of the forest at 100 years. With the limited soil disturbance level under this alternative, birch would likely continue its rapid decline in presence on the forest. Areas actively managed for pine would have sufficient disturbance to maintain some aspen and birch as secondary species.

The two alternatives (1 and 6) and their impacts discussed above are the extremes of the range for the forest management alternatives considered. The middle alternatives (2-5) define intermediate management levels and effects. The primary differences are that Alternatives 2 and 3 produce older red and white pine with younger aspen, red oak, and white birch as important secondary species. Then, under Alternatives 4 and 5 the pine component would be the same but the secondary species, (aspen, white birch, and red oak) would be older and less abundant, being replaced by more northern hardwood species.

Old growth forest conditions under the various alternatives are another important component of forest composition. This topic is discussed further in a section below.

Because aspen is a highly important species for game habitat and certain forest products the impacts to aspen levels under each of the alternatives is compared below in table 2.2—Dominated by Aspen. Alternatives 2-6 would manage for a decrease in aspen from current levels, with the most dramatic decreases in Alternatives 5 and 6.

**Table 2.2 Future percent of aspen in each alternative, 50 and 100 years.**

Percent of Aspen in:	50 years	100 years
<b>Alternative 1</b>	33 %	33%
<b>Alternative 2</b>	30%	20%
<b>Alternative 3</b>	30%	20%
<b>Alternative 4</b>	28%	18%
<b>Alternative 5</b>	25%	15%
<b>Alternative 6</b>	23%	10%

Notes:1) Currently 33% of the NH-AL is dominated stands by aspen.  
 2) Table 2.2 only compares the relative level of forest stands where aspen is the dominant tree species. Under all alternatives, aspen is a secondary component of many stands, and it would be a relatively abundant component under Alternatives 1, 2, and 3.

**Old-Growth Forest:** Another fundamental difference between these Alternatives involves the amount of land managed for old-growth characteristics.

In Alternatives 1 and 2, only upland areas with best opportunity would be managed specifically for old-growth characteristics.

In Alternative 3, upland areas with the best and very good opportunity would be managed for old-growth characteristics.

In Alternative 4, upland areas with best, very good, and good opportunities would be managed for old-growth characteristics.

In Alternative 5, upland areas with the best, very good, good, and moderate opportunity would be managed for old-growth characteristics.

In Alternative 6, the old-growth sites from Alternative 5 plus additional passively managed areas (Wild Resources Areas) would have old-growth forest characteristics.

Refer back to table 2.1 for more information on the old growth sites covered in each alternative.

The amount of old-growth forest conditions that would occur under each alternative is shown below in table 2.3.

Currently, small openings are maintained in European grasses and native bracken grassland. These make up about 0.5% of the NH-AL (as of the late 1980s) and provide forest edge habitat for forest game species. Under Alternative 1, additional wildlife openings and larger openings would be created. Management would include mowing of created openings as well as relict openings (natural bracken grassland). Alternative

<sup>2</sup> The total acreage of 78,920 was calculated by adding the 76,140 acres of Mapped Sites and the 4,700 acres of Small Scattered Old-Growth sites, and then subtracting the 1,920 acres of small scattered sites that overlap with the Mapped Sites.

**Table 2.3 Upland forest managed for Old-Growth characteristics by alternative.**

	Alternative 1 and 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
<b>Total Acres</b>	11,060	19,230	33,560	42,390	78,920
<b>(percent of NH-AL total)</b>	(5% )	(8.5)	(15%)	(19%)	(35%) <sup>2</sup>

Notes: 1) These sites were identified by the Community Restoration and Old-Growth Assessment (CROG) and the Biotic Inventory and Analysis of the NH-AL (Eckstein et al. 2001, Epstein et al. 1999.) The acreages designated for upland old-growth management shown in that table are smaller than the acreage listed in the CROG and Biotic Inventor table sites because the Biotic Inventory and CROG sites contain forested and unforesteds wetlands and open water.

2) Alternative 6 includes both old-growth and upland Wild Resources Areas. These acreages include only upland areas, according to the Natural Communities Distribution database. (Eckstein et al. 2001). A very small percentage of this acreage would be uplands managed for pine barrens rather than old growth. The total upland includes a small amount of grass and upland brush which would be unlikely to produce a forest with old-growth characteristics in the near future.

1 provides the greatest amount of openings. Alternative 2 includes mowing existing created and relict openings. Alternatives 3 and 4 include mowing existing created openings only. In Alternative 5, some wildlife openings would be eliminated, and others maintained by mowing. In Alternative 6, no created wildlife openings would be maintained. Natural bracken grasslands would be maintained except in Wild Resources Areas.

## WILDLIFE

The forest's composition, discussed earlier, has a direct relationship on wildlife as the habitat determines which species will thrive and which will not. While each of the six alternatives offers habitat for all wildlife species present on the forest today, each alternative offers a slightly unique emphasis, the primary differences being in the amount of early successional forest (aspen/birch) and older forest dominated by larger pine and northern hardwoods.

Under Alternative 1, there would be somewhat more early-successional wildlife habitat. Species such as white-tailed deer, ruffed grouse, and a variety of non-game wildlife favors the habitat provided by more and younger aspen. Ruffed grouse relies heavily on young aspen. Over time there would likely be an increase in ruffed grouse populations above present levels. The current high white-tailed deer numbers may increase under this alternative; however, other factors like recreational feeding may have a larger impact on populations than winter habitat, i.e., young aspen. White-tailed deer populations are high on the NH-AL, exceeding population goals for the past decade. Forest birds, such as the golden-winged warbler, that inhabit early-successional forests would benefit. Conversely, forest birds and other species that rely on northern hardwoods or older pines would decline in abundance on the NH-AL under Alternative 1 due to lower habitat levels.

Wildlife species that rely on early successional aspen forests would have decreasing amounts of habitat across Alternatives 2-6. While no species on the NH-AL are old-growth obligates, several benefit from mature pine, hemlock, northern hard-

wood, and black spruce forests. These species, including some forest warblers and flycatchers, would have more potential habitat in Alternative 6, and decreasing amounts of habitat in Alternatives 5 through 1.

Bird species that rely on pine forests would have the least amount of habitat in Alternative 1, increasingly more habitat in Alternatives 2-4, and then decreasing amounts of habitat in Alternatives 5 and 6. These birds include the evening grosbeak, pine siskin, red crossbill, and pine warbler (Hoffman pers. comm. 2003; WDNR Preferred Alternative; Epstein et al. 1999). Many of these birds follow periodic emergencies of food from pine cones and may have nomadic populations on the NH-AL.

Porcupine and American marten would likely benefit from increasing mixed pine forest habitat.

Wildlife species that rely on lakes, streams, and wetlands would be minimally affected by any of the upland forest management options described in the Land Management Alternatives. This includes eagles, loons, fish, aquatic invertebrates, ducks, and aquatic/wetland plants.

## ENDANGERED AND THREATENED SPECIES

Endangered, threatened, and special concern species were identified in the Biotic Inventory and Analysis of the Northern Highland-American Legion State Forest (Epstein et al. 1999). A list of these species can be found in the Appendix. On the NH-AL, about 75% of the rare plants and animals were found in wetland habitats. Two US threatened animals, the bald eagle and timber wolf, were found on the NH-AL. The NH-AL is used by three known wolf packs (Wydeven and Wiedenhoef 2002, Wydeven personal communication 2003) and contributes one of the highest known regional concentrations of bald eagle, osprey, and common loon.

The US threatened timber wolf preys on species such as white-tailed deer and beaver, which favor aspen forests.

Timber wolves are habitat generalists and their distribution is not tied to aspen or early-successional forest types. Wolf habitat is tied to lower density of open roads, higher patch size, and lower levels of edge between land cover types (Mladenoff et al. 1995, Wydeven et al. 2001). Over time, sharp reductions in aspen, such as in Alternatives 5 and 6, may lead to slow reductions in white-tailed deer. Surrounding public and private land and the many private in-holdings could also support deer populations, particularly if recreational feeding of deer continues on private land. White-tailed deer abundance currently exceeds population goals. Wolves are not currently limited by deer populations, but may become limited by prey at a low deer abundance. On the other hand, Alternative 6 would provide extensive areas with low open road densities, which may benefit the timber wolf.

Across the Alternatives, lakes, streams, and unforested wetlands would be protected. Forested wetlands would have timber harvest in Alternatives 1-4 and no timber harvest in Alternatives 5 and 6. Harvest of forested wetlands would decrease older black spruce and tamarack habitat, which would likely have a negative impact on rare species such as yellow-bellied flycatcher and boreal chickadee. In Alternatives 5 and 6, the state threatened red-shouldered hawk and special concern northern goshawk would have a gradual increase in potential forest interior habitat. Cerulean and black-throated blue warblers, which favor interior northern hardwood forest, would also see a decrease in potential habitat in Alternatives 1 and 2 and an increase in habitat in Alternatives 5 and 6, although the land capable of supporting northern hardwoods is limited on the NH-AL due to predominately outwash soils. Bald eagles and osprey, which rely heavily on nest trees on the shorelines of lakes, would not be negatively impacted by any of the Alternatives.

High populations of white-tailed deer may impact populations of rare plants such as showy lady's slipper (Epstein et al. 1999, Martin 1995). Deer browse also affects the regeneration of white pine, eastern hemlock, and northern white cedar. Populations of white-tailed deer are unlikely to decline significantly as a result of land management proposed in most of the Alternatives. However, Land Management Alternatives 5 and 6 and options with more Wild Resources Areas would decrease aspen abundance, and may lead to slow reductions in white-tailed deer populations.

## IMPACTS TO RECREATIONAL AND AESTHETIC RESOURCES

**Recreational facilities:** Land management activities would have little impact on developed recreational facilities and their related activities, including boating, swimming, and camping. All management near developed recreational trails, campgrounds, lakes, and other facilities are routinely adjusted to retain their aesthetic quality.

**Hunting and wildlife viewing:** Due to variations in wildlife habitat across the alternatives, as discussed above under vegetation and wildlife impacts, each alternative would offer somewhat different hunting and wildlife viewing opportunities. Alternatives 5 and 6 have significantly less early successional habitat than the others and may provide fewer opportunities for hunters to find game species in the forest, particularly ruffed grouse. Because deer populations are high within the NH-AL, deer will likely be abundant on the NH-AL for many years even with small reductions in aspen acreage over time. Those alternatives with more Wild Resources Areas would have fewer open woods roads and less opportunity for hunters to drive into areas, but more opportunities for walk-in hunting experiences with, perhaps, lower hunter densities. The greatest opportunity to see a variety of birds, including many rare birds, would occur with Alternatives 3, 4, and 5. They have the highest diversity of habitats, including forested and unforested wetlands, pine forests, and areas with old-growth characteristics, since these elements are less common in the region.

**Visual character:** Land management activities, which primarily are related to forest management on the NH-AL, can have a significant impact on a person's aesthetic impression of the forest. These effects, both positive and negative, may result from the long-term visual changes in the vegetative landscape from forest management (like growing larger or old-growth trees, creating open areas or open "park-like" stands of trees, or planting artificial-looking tree plantations). The effects may also be shorter-term secondary visual effects of management activities like clearcuts and scarifications that leave forest debris and disturbed soil.

Land Management Alternatives 1-6 include a range of forest types and management intensities. Land Management Alternative 1 would have the most visual impacts as it has the highest intensity (size and frequency) of forest management activity. Here, most visitors would commonly encounter visual impacts of timber harvests and other management. Under this alternative the general visual character of the forest would vary substantially from the other alternatives and the present condition. There would be more pine plantations, and substantially fewer large, older trees than exist today or would be present under the other alternatives, because the Big Tree Silviculture policy would not be followed.

In Alternative 2 visitors would encounter timber harvests and other management occasionally. Management activities would be less apparent because they would be in smaller patches and less frequent than in Alternative 1. Big trees (especially red and white pine and red oak) would be present as the Big Tree Silviculture Policy would be followed, as it is today. Harvest activity would only be infrequently apparent in Alternative 3, and only rarely noticed in Alternatives 4 and 5. Of all the alternatives, land management activity would be at the lowest level

in Alternative 6 where only about two thirds of the forest would be under active management. Old-growth forest characteristics would be most apparent under alternatives 4 through 6. Older trees, dead and down trees would be common.

The current visual quality of highly important aesthetic areas, including lake and stream shorelines and major highways, would be maintained under all alternatives through the application of special aesthetic management techniques in these areas.

## IMPACTS TO CULTURAL RESOURCES

There is a low probability of significant adverse impacts to known archaeological and historical resources from any of the land management alternatives. For all timber harvests Manual Code 1810.1 would be followed, which prescribes a review process for screening for archaeological sites prior to initiating a wide range of management activities. Additional investigation and precautions are taken in areas of known sites.

## IMPACTS TO SOCIO-ECONOMIC RESOURCES

### FOREST PRODUCTS

**Timber Products:** Currently, timber products from the NH-AL help support primary and secondary wood using industries throughout the region. Timber can be sold either by the cord (mainly for pulpwood) or by thousand board feet as sawtimber. Alternative 1 would have the greatest amount of timber harvesting, with aspen harvest levels similar to current conditions over the next 20-30 years and increasing moderately after that. Large pines and hardwoods would be harvested at higher intensities, leading to a short-term increase and then maintenance of a higher volume of pine and hardwood harvest. In the long-term, aspen harvests would be greater than current levels. In Alternative 2, the short-term emphasis is on maximizing use of products from aspen stands, while the long-term emphasis would be on maximizing growth of large pine trees for timber products. In Alternative 3, overall harvest levels would be similar to current conditions, but over the next 100 years there would be an increase in oak and pine products that could be sold as sawtimber, and a decrease in aspen clearcuts that could provide pulpwood. Alternatives 4 and 5 would have a small increase in acreage treated, but a small decrease in both pulp and sawtimber products. Alternative 6, due to the large acreage designated as wild resources area (which would not be harvested) would produce considerably less timber products than the other alternatives.

While each of the six land management alternatives would have different potential forest product yields, none of these

alternatives would have a significant economic impact on the forest products industry due to the relatively small contribution of the NH-AL to the regional industry. The NH-AL socioeconomic assessment provides an overview of the role of the NH-AL in the regional economy, a 7-county region (Watkins et al. 1999). The assessment shows that while the forest products produced on the NH-AL are important, they comprise only a small part of the product flow from the 7-county region—4.2% (based on stumpage value) between 1992 and 1996. From the perspective of wood-using industries, timber harvests from the NH-AL are intermingled with timber supplies from other land owners in the region. Given the relatively small proportion of regional timber volumes harvested from this property (roughly 4%) and the fluidity of timber flows within and outside the region, it is unlikely that regional wood-using industries would be significantly impacted by expansions, reductions, or shifts in the type of products from NH-AL that could occur under any of the alternatives. Over the long-run, however, cumulative changes in the supply of timber stumpage (either type or volume) from all public lands could have an effect on stumpage prices—not simply within this region, but throughout the Lake States.

**Wetland Products and Non-timber Products:** Though much less significant economically than timber harvesting, the gathering and use of non-timber forest products supplements household incomes and supports local economies and cultures. Non-timber forest and wetland resources include fish and game animals, wild rice, firewood, small branches or boughs for furniture, wreaths, or other crafts, animal pelts, antlers, berries, mushrooms, nuts, medicinal herbs and bark, and ceremonial plants. The Land Management and Recreation Alternatives are expected to have no significant impact on non-timber forest and wetland products. Wild Resources Alternative V, which includes the greatest amount of Wild Resources Areas on the NH-AL, would significantly limit access on forest roads to areas where people may collect firewood, boughs, plants, or other products. Land Management Alternatives would emphasize certain forest communities, such as aspen, pine, or white birch, over others. Land Management Alternatives 5 and 6 would manage for less white birch. Fire in select barrens and pine forest areas would increase berry production. Overall, the Land Management Alternatives would have a small impact on the provision of most non-timber forest products.

## FISCAL IMPACTS TO LOCAL GOVERNMENTS

The Land Management Alternatives would not cause any significant effects on local taxpayers, or on local or county law enforcement or emergency services as there are few local services needed related to land management activities. Further, it is not likely that the vegetation changes or the public access changes that would occur under any of the

land management alternatives would create any secondary social or economic effects large enough to cause significant fiscal impacts to local communities. The most direct potential impact to local governments from land management activities would be changes in logging truck traffic on local roadways. While the heavy truck traffic from timber harvesting under Alternative 1 (the alternative with the highest level of harvesting) would be slightly higher than current levels, the additional truck traffic would be only a very small increase in overall vehicle traffic on the forest. The increase would not create significant road or traffic impacts. Under the other alternatives, vehicle traffic would be at or below current levels.

### **FISCAL IMPACTS TO THE STATE OF WISCONSIN**

**State forest operational costs:** The primary effects on operational costs by land management would be from changes in staffing. Additional staff, beyond current levels, would be required to meet the forest management objectives of all but one of the alternatives. Present staffing levels fall short of meeting existing needs. The reason for the increased need varies across the range of alternatives.

The greatly increased level of timber harvesting under alternative 1, as compared to present levels, would require a comparably higher level of forestry staff. While the harvests under this alternative would be larger and simpler and easier to administer, there would be a substantial increase in forest reconnaissance work. Even though the intensity of management under Alternative 2 is lower than for 1, the staffing needs for Alternative 2 would be at a similar level because there would be more, smaller timber sales.

For Alternatives 3, and 4, the workload remains high, but it shifts progressively toward more selective harvests with an increased workload for marking trees, delineating stands, cruising, sorting products, and administering sales. Also, with generally small harvests, additional staff time would be required for more complicated forest reconnaissance updates, monitoring, and adaptive management for old growth characteristics.

Alternative 5 would also likely require more forestry staff than the current level in order to meet the management objectives for older forests and old-growth characteristics. Here additional staff time would be devoted to developing and applying a variety of adaptive techniques in consultation with other researchers and managers.

The staffing needs for Alternative 6 would likely be at or below current staffing levels due to the significantly reduced acreage under active forest management compared to the other management alternatives.

**State forest revenue:** Timber sales between 1997 and 2001 provided between 66% and 80% of the total NH-AL revenue from timber and recreation. These funds are not directly available for use on the NH-AL. All state forest revenue is deposited into the statewide forestry account and these funds are appropriated by the state legislature in the biennial budget process. The long-term financial impacts of the Land Management Alternatives to timber sale revenue are difficult to predict because variable market forces have a significant impact on revenue from timber sales, and harvest volumes and products will vary over time. Currently, the NH-AL averages over 40,000 cords and 2 million board feet of timber, which generates over \$1.5 million in revenue annually. The level of revenue for the various forest management alternatives would be generally proportional to the level of harvesting that would occur under each alternative.

A comparison of the income levels projected from the various forest management alternatives indicates that in Alternative 1 the overall acreage harvested would increase moderately, but harvests would be larger and more complete than they are currently, indicating a small increase in revenue. Alternative 2 would have a small increase in timber volume from current levels. Alternative 3 would have levels of timber harvest similar to current conditions. Alternatives 4 and 5 would show small decreases in timber harvest, and likely in revenue. In addition, under Alternatives 4 and 5, average acreage of timber sales would be smaller and have less volume per sale, further reducing the revenue from timber products. The smallest amount of timber, and therefore the smallest amount of state revenue, would be produced in Alternative 6 where about 30 percent less of the forest would not have active timber harvesting.



## **RECREATION MANAGEMENT ALTERNATIVES AND THEIR IMPACTS**

The four Recreation Alternatives A-D present a range of options for recreation on the NH-AL, from an emphasis on primitive non-motorized recreation to an emphasis on more developed facilities and motorized recreation. The recreation proposals in the Draft Master Plan combine elements of several of the proposals. Each Alternative is defined by its overall goal. For the current recreation opportunities on the NH-AL, see Chapter 3 of the proposed plan.

### **Alternative A:**

Provide for a variety of recreation activities and experiences, but emphasize primitive style, non-motorized recreation in a remote setting.

**Alternative B:**

Provide for a variety of recreational activities and experiences (including non-motorized and existing types of motorized uses) with an emphasis on non-motorized uses and areas with good access and modest to well-developed facilities.

**Alternative C:**

Provide a variety of motorized and non-motorized recreational activities and experiences in areas with good access and modest to well-developed facilities. This is similar to Alternative B but with a higher emphasis on motorized recreation.

**Alternative D:**

Provide a variety of motorized and non-motorized recreational activities and experiences in areas with good access and modest to well-developed facilities. This is similar to Alternative C but with a higher emphasis on motorized recreational opportunities.

**AN ALTERNATIVE CONSIDERED BUT ELIMINATED FROM FURTHER STUDY**

One Alternative on All Terrain Vehicles (ATVs) was considered and, after early analysis, eliminated from further study. This proposal was presented by the Northwoods ATV Association through the NH-AL planning's public participation process. The proposal involved using existing snowmobile trails to connect Boulder Junction and Lake Tomahawk. The proposed trail included two loops in addition to the main corridor.

This trail was eliminated from further study due to several conflicts inherent in the trail design. The existing snowmobile trail runs through two sizable wetlands in the American Legion portion of the NH-AL. While these wetlands do not pose a problem for snowmobile use, they would not be suitable for year-round ATV use. In the Northern Highland portion of the trail, several conflicts with existing recreational users make the trail unfeasible. In one small area, the snowmobile trail is used as an interpretive nature trail during the summer. In other places, the trail would border areas that are currently used or proposed for remote, non-motorized recreation.

**IMPACTS TO PHYSICAL AND BIOLOGICAL RESOURCES****SOILS**

Recreational use impacts on soils are primarily compaction or erosion. Construction standards used by the Department are designed to minimize and control erosion from construction sites. Some soil loss would occur from campground and road construction, though it would be small, short-term, and localized.

Overall, because of the limited expansion of non-motorized trails under all the alternatives, the acreage of the NH-AL impacted would be small and the potential for significant soil impacts is low. Likewise, the proposed snowmobile trail expansion is limited and that would primarily follow existing logging roads that are already disturbed soils. Winter use of these trails has a low level of impact.

New ATV trails are included in Alternatives C and D, approximately 52 miles and 106 miles respectively. These trails would be constructed on new routes. They are proposed to run along major roads and highways outside of the highway right-of-way (only a one-quarter mile wide corridor was identified). The construction of the ATV trails would generate some short-term soil loss impacts. However, construction standards used by the Department would minimize them. While the soil impacts from construction would likely be small, there is a potential for significant long-term soil impacts from ATV use of the trail. Experience from trails on the Black River State Forest indicates that ATV trails remain unvegetated year-round, while snowmobile trails are typically vegetated over the summer (personal communication Terry Boone 7-11-03). The lack of vegetation on the trails and the wheel-generated soil disturbance and movement, particularly on slopes, significantly increases the erosion rate. There is a high potential that long-term ATV use of these unsurfaced trails would cause significant rutting, soil compaction, and erosion. Careful trail layout and construction to minimize slope angle and to avoid or bridge wet soils along with regular and intensive maintenance and the closure of the trails in wet periods would help mitigate adverse impacts to soils.

**WATER RESOURCES AND WETLANDS**

Motor boats and jet skis also have the potential to impact water quality through impacts on water clarity and quality, shoreline erosion, and impacts on plant communities, fish, and other aquatic wildlife. The very modest expansions of recreational facilities, including water access site improvements and additional camping capacity, would not in themselves generate significant increases in motorized watercraft activity. Therefore, none of the recreation alternatives would cause an adverse impact by motorized watercraft on water quality. Because of the increased level of non-motorized areas being designated in Recreation Alternative A, there would be more lakes without motorized use and impacts would be reduced on those lakes. It is unknown if these additional non-motor restrictions have a secondary impact of shifting the traffic to other lakes, increasing the level of adverse impacts there.

Except for the proposed ATV trails, discussed below, none of the recreation alternatives would create a significant change, positive or negative, on lakes and streams. Under the most aggressive campground expansion alternative, only 110 campsites would be developed at various campgrounds across the

forest. As discussed above under Soils, soil disturbance from construction would only be short-term and a relatively small level. Even though the campgrounds may be near lakes (minimally a 75-foot campsite setback), any increased water run-off from construction would be negligible because of the relatively small and dispersed area affected, the erosion control measures used during construction, and the highly permeable soils.

The ATV trail proposals in Alternatives C and D and the Preferred Alternative have the potential for significant adverse impacts to wetlands and some impact to water quality. The C and D trail alternatives were not specifically sited, only a general corridor along existing highways was identified, so a detailed, site specific analysis of impacts is not possible. In general, there are two primary sources of wetland and water quality impacts—those from trail construction/use and from illegal ATV riding off-trail. Each is discussed below.

Local shoreland/wetland zoning regulations must be followed, as well as receiving state, and sometimes federal, permits when constructing an ATV trail across streams and wetlands. Crossing wetlands would either require bridging or adding in fill (with culverts) to create a base. The wetland impacts would vary depending upon the construction method used. Local site impacts would occur during construction. There would be soil compaction and rutting, and damage to vegetation. The NH-AL's wetlands have a high abundance of rare plants. Where fill is used for the trail bed, there would be a permanent loss of wetland vegetation. The potential long-term effects are changes to wetland hydrology (reduced or altered water flow) and sedimentation from the unvegetated, bare soil on the trail. Another potential adverse impact of the introduction of an ATV trail across a wetland is the spread of aggressive invasive species, which adversely affect native wetland plant communities.

The Preferred Alternative (March, 2003) proposed an 8-mile trail that would connect an Iron County ATV trail in the town of Manitowish to the Lac du Flambeau reservation. The trail runs through the Manitowish Peatlands on an abandoned railroad grade and road grade. The potential for impact from use of this old grade are minimal. However, the southern one mile run of the proposed trail route, from Highway 182 to the Lac du Flambeau Reservation, lies off of the old grades and is mostly across wetland. Uplands in the area are privately owned and not available for the ATV trail. Even with bridging the wetland, if it is possible, there is high potential for significant adverse impacts on this section of trail, due to the extent of the wetland crossing.

As discussed above under Soils, soil erosion from trail construction and during long-term use may degrade water quality in nearby lakes and streams. Recreation Alternative C would require 16 stream or lake crossings, including crossing the Trout River, Manitowish River, Minocqua Lake, and

Horsehead Creek. Alternative D adds five additional stream crossings, including Mann Creek and Stevenson Creek. Because only the general potential route of the trails is known, a detailed impact assessment is not possible, but the large number of stream crossings indicates there is the potential for significant adverse impacts to water quality.

Illegal use of ATVs is already causing environmental damage on the NH-AL, and is likely to be a problem along ATV trails, as well. On the Black River State Forest, experience with ATV trails indicates that ATVers are most likely to ride off-trail at stream crossings in remote areas (personal communication Terry Boone 7-11-03). Wetlands are easily damaged, the adverse impact of even a single off-trail ATV event in a wetland can last for several years. Given the abundance of wetland and stream crossings and the fragility of these habitats there is high potential for significant environmental damage from illegal ATV use near the proposed trail routes.

### **UPLAND VEGETATION AND WILDLIFE**

None of the Recreation Alternatives would have a significant impact on vegetation or wildlife, due to the relatively small area affected by the proposed campground expansion and trail development.

### **ENDANGERED AND THREATENED SPECIES**

There is a very low probability that the developments proposed under any of the Recreation Alternatives would have a significant adverse impact on endangered and threatened species. All developments would be located away from known endangered and threatened species sites, which are primarily in wetlands.

### **IMPACTS TO RECREATIONAL AND SCENIC RESOURCES - RECREATION MANAGEMENT**

The four Recreation Alternatives and the six Wild Resources Alternatives provide a wide range of recreation opportunities; from somewhat undeveloped and primitive to more highly developed. Recreation Alternative A has an emphasis on primitive, non-motorized recreation while Recreation Alternative D has an emphasis on motorized recreation with moderate to well-developed facilities. Wild Resources Alternatives I-V provide a range of wild resources experiences. Alternative I has the fewest number of Wild Resources Areas, while Alternative V has the greatest number of Wild Resources Areas.

**Camping and day use areas:** The NH-AL currently has 867 family campsites, two group campgrounds for 160 campers

and 86 primitive back-country style (canoe and wilderness) campsites. The Alternatives present a range of options for campgrounds on the NH-AL that include both reductions and increases of current campsite levels. Alternative A offers the least amount of camping, and would cut back current campsite numbers. Alternatives B, C, and D would increase both rustic and modern camping on the forest by varying amounts, and they also would double the group camping capacity. The net change from present NH-AL campsite levels for each of the alternatives would be:

- Alternative A – 9% reduction of family campsites
- Alternative B – 7% increase of family campsites
- Alternatives C and D – 13% increase of family campsites.

Of all the alternatives C and D offer the largest change in the type of camping opportunity on the NH-AL by shifting more toward modern camping and away from rustic camping. There would be an increase of modern campsites by 66% (180 sites), some with electrical hook-ups, and a reduction of rustic camping by 14% (70 sites). There would be a small, unspecified increase in the number of canoe and wilderness campsites under all the alternatives. Table 2.4 shows the detailed changes in camping opportunity under each Alternative.

In every alternative the opportunity for swimming and picnicking at day use areas would increase with the addition of a new site at Carrol Lake.

**Boating and canoeing:** The NH-AL currently maintains over 100 designated boat landings, including 73 cement plank, 33 unpaved sites, and 11 carry-in sites. Only slight changes would occur across the alternatives. No change would occur under Alternative A. All the other alternatives would build two new access sites. They would be on Carrol and Clear Lakes. This would significantly reduce congestion and conflicts at these access sites. The new landing may promote some additional boat traffic on these lakes. Impact on boating and canoeing opportunities due to the potential designation of additional wild resources (non-motor) areas is discussed in the Wild Resources Alternatives section.

**Fishing and swimming:** None of the recreation alternatives propose any actions that would change the current fishing and opportunities on the forest.

**Recreational trails:** Recreation Alternatives present a range of options for a variety of trail uses. The most significant change proposed is to provide ATV riding opportunities. Alternatives C and D propose the development of approximately 52 miles and 106 miles of ATV trail respectively. Currently there are no ATV trails on the NH-AL. For snowmobiling, one alternative, Alternative A, reduces the current trail 400+ miles by 21% (70 miles). All other alternatives maintain the current snowmobile trail mileage on the forest.

The Alternatives also provide a range of changes to non-motorized trail opportunities. The changes are detailed below in table 2.5. Most of the changes are small and would not significantly alter the current recreational opportunities on the forest. The largest addition is for backpacking. New trails would be added under all alternatives with Alternative A offering the most opportunity with four new trails. The trail lengths are not specified. Also of note, opportunities to ski-groomed trails would be reduced under Alternative A to about half the current level.

**Access to woods roads:** Many areas of the NH-AL are accessible due to abundant forest and town roads. Unless gated or bermed, forest roads are open to street licensed motor vehicles. Alternative A would close some roads to motor vehicles, while Alternatives B, C, and D retain approximately current levels of motorized access to woods roads with continual opening and closing of roads across the forest.

**Hunting and trapping access:** Hunting and trapping opportunities are abundant on the NH-AL given the large land base and diverse forest types. These will continue to be abundant in the future under any of the land management alternatives. Hunting and trapping access would be more difficult under Recreation Alternative A because more acreage would be designated for non-motorized use. However, this would create an increase in opportunity for hunters that enjoy walk-in hunting. Motorized access under the other alternatives would be at or above current levels.

**Education and interpretation:** The NH-AL currently maintains four interpretive trails and one interpretive canoe trail. A rustic nature center exists in the Crystal-Muskie Campground area, and interpretive programs are held from Memorial Day to Labor Day at NH-AL campgrounds. The NH-AL's education and interpretive programs are highly popular and in high demand.

The education and interpretation alternatives cover a wide range of expanded opportunities beyond the existing facilities and programs. The expanded education and interpretation developments would be smallest in Alternative A and most extensive in Alternative D. Table 2.6 compares education and interpretation alternatives and benefits.

## SCENIC RESOURCES AND RECREATIONAL ENVIRONMENT

The modest recreational facility developments proposed in the alternatives would not have a significant adverse impact upon scenic quality of the state forest. Most facilities would be sited away from the most sensitive scenic sites. Campground expansions near lakes and streams would follow local shoreland zoning requirements and have a minimum 75-foot setback. Additional or upgraded water access sites would

**Table 2.4 Camping and day use alternatives.**

	<b>Current Condition</b>	<b>Alternative A</b>	<b>Alternative B</b>	<b>Alternative C</b>	<b>Alternative D</b>
<b>Rustic campgrounds</b>	14	13	13	12	12
<b>Total sites</b>	518 sites	491 sites	530 sites	448 sites	448 sites
<b>Modern campgrounds</b>	4	4	4	6	6
<b>Total sites</b>	352 sites	297 sites	397 sites	532 sites	532 sites
<b>Group campgrounds</b>	2	2	4	4	4
<b>Total group capacity</b>	100	100	~200	~200	~200
<b>Canoe sites</b>	74	74	74	74	74
<b>Reservable remote sites<sup>3</sup></b>	12	12	12	12	12 + disabled access site
<b>Backpack sites</b>	0	0	0	0	0
<b>Generator use in campgrounds</b>	Some areas, some times	None	Some areas, some times	Some areas, more times	More areas, more times
<b>Electrical hook-ups</b>	None	None	None	~30-70 sites	~100-150 sites
<b>Day use areas</b>	11	9	9	9	9

<sup>3</sup> The Alternative document erroneously stated that there are 13 reservable remote campsites on the NH-AL. There are actually 12 reservable remote campsites.

**Table 2.5 Comparison of the Education and Interpretation Alternatives and Benefits**

	<b>Facilities and Opportunities</b>
<b>Alternative A</b>	All existing facilities plus: <ul style="list-style-type: none"> <li>• Expanded self-guided nature trails</li> </ul>
<b>Alternative B</b>	All facilities proposed in Alternative A plus: <ul style="list-style-type: none"> <li>• A new disabled access interpretive trail and amphitheater at the Crystal-Muskie nature center</li> <li>• A new small nature center at Clear Lake Campground</li> <li>• A new, year-round visitor center at the State Forest Headquarters</li> </ul>
<b>Alternative C</b>	All facilities proposed in Alternatives A and B plus: <ul style="list-style-type: none"> <li>• Add a disabled accessible trail at the proposed visitor center.</li> <li>• Add an interpretive bike trail and a self-guided auto tour trail</li> </ul>
<b>Alternative D</b>	All facilities proposed in Alternatives in A, B, and C plus: <ul style="list-style-type: none"> <li>• Upgrade the Crystal-Muskie Nature Center facilities to include flush toilets and hot/cold water</li> <li>• Build the proposed Clear Lake Nature Center to the same level as the Crystal-Muskie Center</li> <li>• Add additional disabled trails in several locations.</li> </ul>

have a small, localized visual impact on the lake or stream shoreline.

The recreational environment provided would vary somewhat across the four recreational alternatives.

Alternative A, which emphasizes primitive, remote recreation, would provide a more quiet, solitary experience and a more undisturbed and natural scenic quality than current conditions. The recreational environment under Alternative B would be similar to current conditions. Recreation Alternatives

C and D would be a shift of the recreational character of the forest toward being noisier and less solitary with a somewhat more developed quality. This is due to more developed camping facilities and more motorized recreation, particularly the addition of ATV trails. A mitigating factor is that the ATV trails are proposed to be along busy highways, which would tend to reduce the adverse impacts on other recreational users. While expanding the number of campsites in popular campgrounds would reduce the competition for campsites, during peak use times the additional sites may raise the noise and use levels somewhat in adjacent areas. Overall, recre-

**Table 2.6 Trail alternatives evaluated for the NH-AL.**

<b>ATVs</b>	<b>Current Condition</b> None	<b>Alternative A</b> None	<b>Alternative B</b> None	<b>Alternative C</b> 52 miles	<b>Alternative D</b> 106 miles
<b>Snow-mobiling</b>	Over 400 miles	70 mile reduction	No change from current mileage	No change from current mileage	No change from current mileage
<b>Biking-Mountain</b>	4 trails, 39 miles	No change from current	No change from current	Some new trails along forest roads	No change from current
<b>Biking-Paved Trail</b>	Boulder Junction trail run by town	No change from current	No change from current	No change from current	No change from current
<b>Hiking/ Backpacking</b>	3 hiking trails, 15.5 mi. No designated backpack trails.	1 new at Clear Lake, 4 new backpack trails	1 new at Clear Lake, 3 new backpack trails	1 new at Clear Lake, 1 new backpack trail	1 new at Clear Lake, 1 new backpack trail
<b>Skiing</b>	7 groomed trails, 70 mi (WDNR, volunteer, land use agreement)	3 groomed trails	No change from current	No change from current	8 groomed trails, plus trail expansion
<b>Snowshoeing</b>	Allowed except on groomed ski trails	1 new trail	1 new trail	1 new trail	1 new trail
<b>Horseback Riding</b>	No trails, many opportunities across forest	No change from current	No change from current	No change from current	No change from current

ational conflicts from noise, crowding, and incompatible behavior of people sharing trails and other facilities would be greater under Alternatives C and D.

## IMPACTS TO CULTURAL RESOURCES

The probability of significant adverse impacts to archaeological and historical resources from development under any of the recreation alternatives is low. Prior to any recreational facility development of trails, campgrounds, and buildings, the Department must complete a review process (Manual Code 1810.1) designed to preserve historic and archaeological resources.

## IMPACTS TO LOCAL COMMUNITIES, GOVERNMENTS, AND TAXPAYERS

**General economic and social impacts:** Impacts to local communities from recreation include both the social impacts of different users in the area and the economic impacts of recreational changes.

Except for ATV trails, none of the recreational proposals in the alternatives would generate a significant change in area tourism or business activity, considering the modest range of recreational changes proposed. For example, the largest change in camping would only be a net increase of 162 campsites (14%) under alternative D. While Alternative A would reduce the snowmobile mileage on the forest by about 10

percent (40 miles) it would not likely cause a measurable reduction in the number of snowmobilers visiting local communities because of the very large regional trail network available.

The proposed All-Terrain Vehicle (ATV) trails (Alternatives D and C) across the forest and linking local communities has the most potential to generate both social impacts and increased revenue in local communities. Many residents moved to the NH-AL to enjoy the peace and quiet of the northwoods, and have built their recreational uses around activities that do not involve ATVs and may be negatively impacted by ATVs. ATVs are growing in popularity in the region and state, however, and many users are seeking ATV riding opportunities on the NH-AL and surrounding lands. The introduction of ATVs would likely help support some businesses that could cater to the needs of the ATV community. The economic impacts of ATVs will vary by season. The greatest economic need for increased tourism around the NH-AL occurs in the spring and fall “shoulder seasons” and during winters with little to no snow. During the summer, the Minocqua-Woodruff area is crowded and many of the campgrounds, motels, and resorts are full to capacity on summer weekends. ATVs would likely have a low positive and possibly a negative economic impact during the already popular summer season. During the spring and fall, ATV trails across the state are closed for 1-2 months during the wet seasons to avoid rutting and erosion, and to provide managers an opportunity to do maintenance work on the trails. During the winter, most ATV trails are shared with snowmobiles.

**Fiscal impacts to local governments:** The recreation Alternatives would have no significant change in demand on local law enforcement and there would be the potential for small increased demand for emergency services. Most law enforcement issues on the forest are handled by NH-AL rangers, rather than the local police or the county sheriff. There may be a small increase in the demand for local emergency services due under the alternatives with ATV trail development.

The small increases in recreational use that would be generated by any of the recreation alternatives would not cause a significant increase in vehicle traffic on the forest. Campground expansions would likely lead to a slight increase in local traffic on summer weekends. The small decrease in trails and campsites under Alternative A would have no significant impact on local traffic, although roads near campgrounds that are reduced in size or are closed would likely have somewhat less traffic.

**FISCAL IMPACTS TO THE STATE OF WISCONSIN**

**State Forest operational costs:** Alternatives A-D all propose changes or additional facilities that would require extra staff time. The changes to recreation Alternative A would initially generate additional costs and workload, compared to existing levels, in order to make changes to campgrounds and trails, but over the long-term the workload would drop below present levels. The cost and workload would stay at about present levels for Alternative B. The greatest increases in operational costs and recreational staff needs (for facility maintenance and law enforcement) would be under recreational Alternatives C and D. There, the addition of ATV trails would likely generate a significant new maintenance and law enforcement workload

(M. Brandt, personal communication 2003). The proposed campground expansions of 162 campsites would generate only a small increase on law enforcement workload and maintenance costs.

Increases in Wild Resources Areas proposed under the Wild Resources Alternatives may increase the overall law enforcement workload. This is because of the need to patrol and enforce the access and use restrictions. Further, the limited, more difficult access to these areas further increases the time required for rangers to perform enforcement duties.

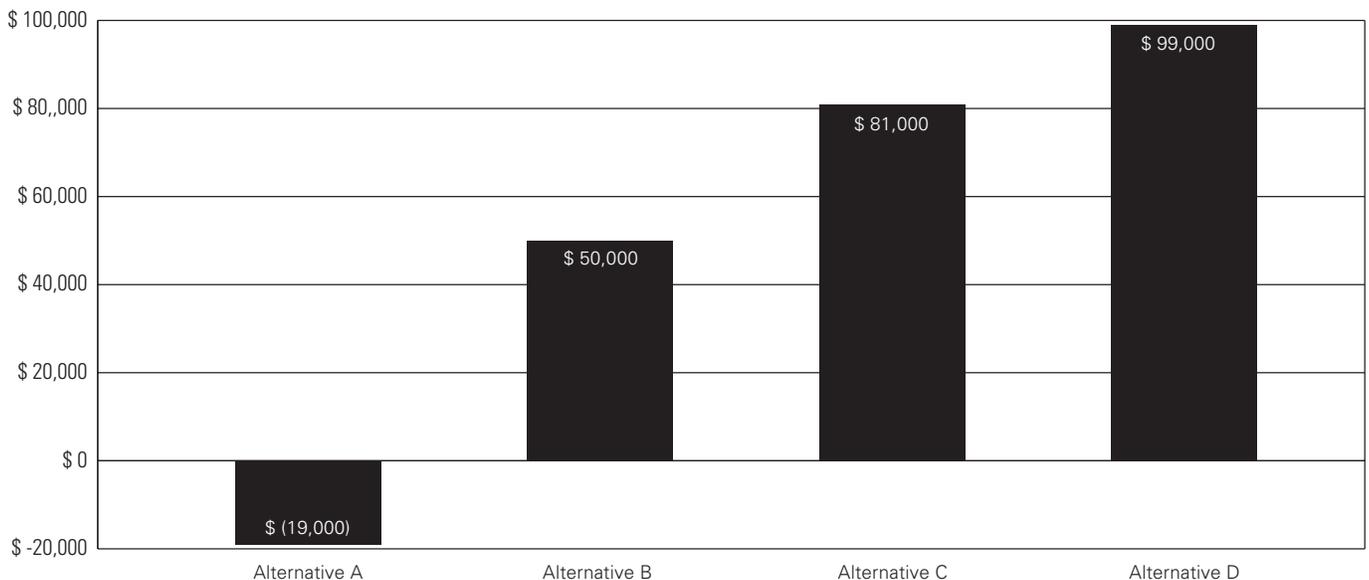
**State Forest revenue:** Depending on camper use, admission stickers, and trail passes purchased, recreational revenue has ranged from \$590,000 to \$700,000 per year since 1997. Average recreational revenue from 1999-2002 was used to estimate approximate revenue changes from current levels for each of the Alternatives.

As shown in Figure 2.7 below, State Forest revenues would increase over the 1999-2002 year levels under all recreation alternatives, except one.

Recreation Management Alternative A would have about a \$35,000 decrease in recreational revenue due to reductions in campsites, a \$4,000 decrease in revenue from reduction of cross-country ski trails, and a \$20,000 increase in revenue from the addition of the day use area.

Alternative B would provide for a \$30,000 increase in revenue from increases in campsites and a \$20,000 increase in revenue from the new day use area.

**Figure 2.1 Potential Revenue Change for Each Recreation Alternatives**



Alternative C would have a \$50,000 increase in revenue from increases in campsites, a \$11,000 increase in revenue from the addition of electrical hook-ups at campsites, and a \$20,000 increase in revenue from the day use area.

Alternative D would provide a \$50,000 increase in revenue from increases in campsites, a \$28,000 increase in revenue from the addition of electrical hook-ups at campsites, a \$20,000 increase in revenue from the day use area., and a \$1,000 increase in revenue from a new cross country ski trail.

Snowmobile and ATV trail Alternatives for the NH-AL would not result in changes in revenue to the state, because snowmobile and ATV trail passes are purchased statewide, and would be negligibly impacted by trails on the NH-AL.



## WILD RESOURCE AREAS ALTERNATIVES AND THEIR IMPACTS

Wild resources areas are places of remote recreational experiences, places where people can hike or canoe without seeing or hearing signs of human activity. Consequently, motorized recreation is not allowed and only the least developed recreational facilities are present in these areas. Resource management activities, such as forest harvests, may occur under some designations but are not readily visible. A wide range of potential Wild Resources Areas designations was developed and presented to the public for review in Progress Report Number 10. The alternatives primarily vary by the amount of area designated.

**Wild Resources Alternative I:** One Wild Resource Area totaling 6,150 acres.

**Wild Resources Alternative II:** Six Wild Resources Areas totaling 28,115 acres.

**Wild Resources Alternative III:** Seven Wild Resources Areas totaling 36,424 acres.

**Wild Resources Alternative IV:** Thirteen Wild Resources Areas totaling 62,688 acres.

**Wild Resources Alternative V:** Seventeen Wild Resources Areas totaling 80,354 acres.

Note: The current NH-AL master plan (1982) designates the Manitoish Wilderness Area, 6,150 acres, and three Wild Areas totaling 26,920 acres. While the current designated wild areas offer opportunities for non-motorized recreation, particularly in the summer, much of these areas have a higher level

of management activity than would occur in the wild resources areas proposed in the alternatives. Due to recent changes in the Department's land classification system (WI Admin. Code NR 44) the current wild areas do not qualify as wild resources areas.

## IMPACTS ON RECREATIONAL OPPORTUNITIES

Wild Resources Alternative I would maintain the current condition, which is to retain the 6,100-acre Manitoish Wilderness Area with no additional areas being designated. Wild Resources Alternatives II-V would provide an increasing acreage of designated area. For those seeking more remote, solitary recreational experiences in a wild-appearing landscape, their opportunities under the five wild resources alternatives would vary widely from the current level, 6,100 acres, up to more than 80,000 acres. This is 13 times the acreage now available on the forest.

Designating wild resources areas creates trade-offs with other styles of recreation. Within the Wild Resources Areas, motorized recreation and other more intensive forms of use or development would not be allowed. Comparatively, Alternative I favors motorized recreation and access and Alternative VI strongly favors non-motorized recreation and access. As the amount of acreage designated for wild resource areas increases through the range of alternatives a greater number of existing motorized or well-developed trails and roads would be closed or relocated, or, for new trails, would be developed in locations outside of the wild resource area. Motorized watercraft use would also be precluded on lakes within Wild Resources Areas.

On one hand, Wild Resources Area designation would limit motorized access; on the other it would increase the opportunity for non-motorized and remote recreational experiences. The level of impact, positive or negative, by any alternative would generally be proportionate to the size of the areas designated.

Table 2.8 illustrates the maximum potential impact that would occur because some of the trails or trail segments could be relocated to areas outside of the wild resources area.

## IMPACT ON LAND MANAGEMENT

This is discussed in the Land Management Alternatives section.

**Table 2.7 Compatibility of the Wild Resource Area Alternatives and the Recreation Alternatives for the NH-AL.**

	<b>Wild Resources Areas Alternative I (3 areas)</b>	<b>Wild Resources Areas Alternative II (5 areas)</b>	<b>Wild Resources Areas Alternative III (6 areas)</b>	<b>Wild Resources Areas Alternative IV (11 areas)</b>	<b>Wild Resources Areas Alternative V (13 areas)</b>
<b>Recreation Alternative A</b>	Compatible	Compatible	Compatible	Compatible	One area incompatible due to a bike trail.
<b>Recreation Alternative B</b>	Compatible	Two areas incompatible due to snowmobile trails.	Two areas incompatible due to snowmobile trails.	Five areas incompatible due to snowmobile trails and one due to a bike trail and a snowmobile trail.	Six areas incompatible due to snowmobile trails and one due to a bike trail and a snowmobile trail.
<b>Recreation Alternative C</b>	Compatible	Two areas incompatible due to snowmobile trails.	Two areas incompatible due to snowmobile trails.	Five areas incompatible due to snowmobile trails and one due to a bike trail and a snowmobile trail.	Six areas incompatible due to snowmobile trails and one due to a bike trail and a snowmobile trail.
<b>Recreation Alternative D</b>	Compatible	Two areas incompatible due to snowmobile trails.	Two areas incompatible due to snowmobile trails.	Five areas incompatible due to snowmobile trails and one due to a bike trail and a snowmobile trail.	Five areas incompatible due to snowmobile trails, one area due to ATV and snowmobile trails and one due to a bike trail and a snowmobile trail.



**BOUNDARY EXPANSION ALTERNATIVES AND THEIR IMPACTS**

**THE 90,000-ACRE NORTHERN BOUNDARY EXPANSION**

This large expansion was proposed in the Alternatives (January 2002). It is an expanded version of the proposed master plan’s northern boundary expansion. Therefore, the positive and negative impacts of boundary expansion discussed in Chapter 1 would apply to this alternative as well, and generally to a proportionally larger degree. The master plan proposes an expansion of 55,000 acres, omitting the lower priority lands, such as well-developed areas, from the proposed boundary. Compared to the master plan’s proposal, this expanded boundary alternative would especially have substantially greater acquisition costs, because of the additional acreage and also because of the substantially greater level of development present within the area. Over the long-term, if more land were purchased there would be more land available for public use and more land protected from various types of private development. However, the lands with the higher natural

resource value lie within the master plan’s proposed acquisition boundary.

**THE NO BOUNDARY EXPANSION ALTERNATIVE**

Under the no expansion, or no action alternative, the present NH-AL boundary and acquisition goal would remain unchanged, and lands outside of this boundary would not be purchased. The current NH-AL boundary includes 345,000 acres. The state has an acquisition goal of 226,200 acres within this boundary. Currently, 99% of this goal has been purchased.

If these lands are not purchased by the state, most of the public benefits of permanent protection of important habitats, forest production, recreation lands, and water resources would not occur. The development trend across the north will continue. Over time much of the undeveloped land in the expansion area will become developed, greatly reducing habitat and natural scenic values. Lake and stream frontage being in the highest demand will tend to be developed first. Undeveloped water frontage is one of the most limited and critical resources, having highly important habitat and scenic values. Across the area ecological values will degrade as

development fragments habitats. Development would also highly impact scenic and historical resources as these sites are concentrated near water lakes and streams, the very areas most in demand for development.

Compared to state ownership, private development would increase the demand for local government services, such as law enforcement, emergency services, roads, and schools. The increased demand for services may force a rise in local taxes if the increased property value does not keep pace with the costs. However, a net positive impact could also occur fueled by the area's rapidly increasing property values and the high percentage of second homes, which do not place increased demands on local school costs. As discussed in Chapter 1, because of the low demand for services under state ownership and the aids-in-lieu of taxes formulas that essentially pay local governments the same as if the land were on the tax roles, local governments would likely have less net revenue under private ownership.

The long-term costs to the state for land acquisition, management and development would not occur under the No Action Alternative.

### **ENERGY CONSUMPTION IMPACT - ALL ALTERNATIVES**

While the level of energy consumption would vary somewhat across all the alternatives discussed in this chapter because of differences in management intensity and recreational use, any potential change, plus or minus, in energy use would not be significant compared to the overall energy consumption within the NH-AL boundary.





## **DEMONSTRATION ATV TRAIL ALTERNATIVE**

Note: A Demonstration ATV Loop Trail proposal was developed by the planning team during the draft master plan development process, subsequent to the development of the recreation alternatives A-D. The proposal was included as part of the draft master plan (March 2005). This ATV proposal is not included in the final, recommended plan. Because it was not part of the original alternatives document, it and its impacts are discussed separately below.

The Demonstration ATV trial would be a new and unique type of motorized recreation trail experience for riders of varied skill levels, interests and ages that combines traditional recreation and education with ATV riding. The trail would pioneer innovative management techniques, demonstrate, evaluate, and promote safe and ethical motorized recreation and to integrate traditional recreational activities.

The design for the proposed trail will follow the traditions and philosophy of the forest. The Northern Highland-American Legion State Forest is a leader in pioneering and adapting innovative methods of resource management, particularly in the areas of forest restoration, forest inventory, habitat classification and wildfire control. While forestry is the primary management goal, the state forest has always served a variety of compatible needs. This typically includes outdoor and family oriented recreation. The motorized recreation and outdoor education trail would encourage family participation. It's design and purpose would be a safe and conservative approach to a growing form of recreation.

### **ATV TRAIL OBJECTIVES**

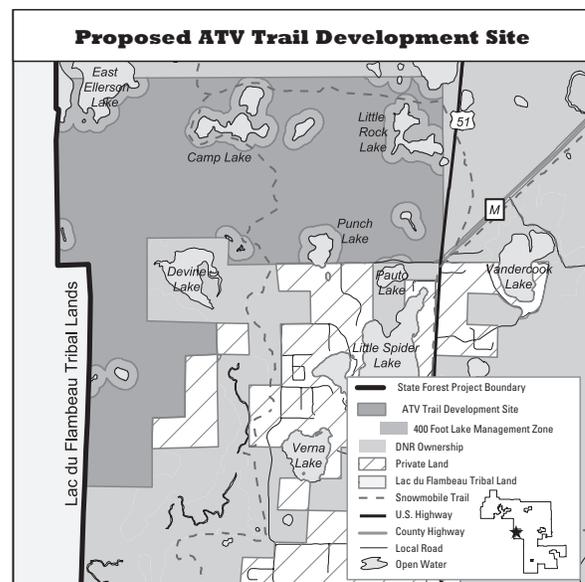
Develop a state-of-the-art recreational "demonstration" and "education" trail where:

- The trail serves as an educational site to train ATV owners, DNR and other agency staff about:
  - "trail skills" — riding skills, safety and rescue, ethics and etiquette.
  - "trail management" — maintenance and development, policy and enforcement.
  - "trail aesthetics" — design & construction, natural resource awareness and appreciation.
  - "trail conservation" — basic conservation concepts, resource stewardship.

- The trail is a field laboratory, serving as a test area where new trail structures, design techniques and trail use are pioneered and researched
- A variety of traditional recreation and education opportunities are integrated with the trail's design, including interpretation of forestry management and ecological concepts.
- The trail is evaluated and monitored regularly for effectiveness of trail design and ecological affects.
- The trail is a cooperative effort of the Dept. of Natural Resources, citizens, recreation groups and other public or private organizations.
- The proposed trail is developed to comply with Wisconsin's evolving criteria for ATV trails on state properties which includes the following evaluation parameters:
  - Property Designation / Funding source
  - Potential Effects on the Resources
  - Safety
  - Social Consideration
  - Economic impact
  - Cooperation
  - Management / Administrative Criteria
  - Enforcement
  - Monitoring

### **PROPOSED TRAIL LOCATION AND MANAGEMENT**

The proposed trail system would be loops totaling 8-10 miles in Little Rock Lake/Camp Lake area west of US Highway 51. The proposed trail site has upland soils and relatively flat terrain. Few alternate recreation uses occur there. The location is currently undeveloped and access is closed to most uses except snowmobile travel. A network of existing logging roads can be adapted for ATV trail use.



The Department of Natural Resources would determine trail opening and closing dates, and may close the trails during times riding would cause unacceptable damage. Time of day and season of use would be determined by a variety of factors including rider interest and demand, rider safety and trail suitability to weather or seasonal variations. Only State registered machines meeting legal requirements for design and safety would be allowed on the trail. All existing regulations and safety rules would apply. The trail would have regular monitoring and evaluation and routine maintenance and law enforcement patrols.

### **A COOPERATIVE VENTURE**

A key to the success of the proposed trail would be the involvement of recreation enthusiasts working in partnership with Department of Natural Resources personnel. Organized ATV groups would be invited to participate and to share expertise. Private assistance would be needed for tasks such as securing funding sources, providing trail maintenance, staffing trail safety patrols, and conducting education and research. The Department will work with the trail partners to determine responsibilities for conducting trail monitoring and evaluation efforts.

### **AN EXPERIMENTAL EFFORT**

The trail will be operated experimentally as a trial project. Annually the trail and its use will be reviewed to determine if the goals and objectives are met and whether the project should be continued or if other operational changes are needed. Success would be measured by the project's ability to achieve sustainability standards set by statewide criteria, to facilitate educational goals, and to attract adequate trail usage to justify efforts put into the venture. If evaluation and inspection determines that goals and sustainability cannot be met or maintained, then the Department may close the trail. And if motorized trail use is terminated, the Department will redesignate the trail system for a suitable alternate recreational use.

### **IMPACTS OF THE TRAIL**

ATV use has high a potential for significant impacts on soils unless significant mitigation measures are employed. Experience from ATV trails on the Black River State Forest indicates that ATV trails remain unvegetated year-round, snowmobile trails become are typically vegetated over the summer. (pers. comm. Terry Boone 7-11-03) The lack of vegetation through the summer and the wheel-generated soil disturbance and movement significantly increases the erosion rate, particularly on slopes. On the NH-AL there is the potential, particularly on the abundant sandy or wet soils, for ATV use to cause significant rutting and erosion. However, if developed as proposed the impacts would be greatly mitigated

through proper trail design and maintenance. Mitigation measures proposed include: 1) careful trail layout and construction to minimize slope angle and to avoid or bridge wet soils along, 2) regular monitoring of trail conditions, 3) intensive maintenance, and 4) closure of the trails in wet periods. In some circumstances, artificial soil stabilization techniques may be required.

Construction activities of the ATV trail may cause short-term, localized impacts to surface waters and wetlands; however, any impacts from construction or use of the proposed ATV trail network are not predicted to be significant. This conclusion is based on several factors:

- 1) the soils in the area where the ATV trail network is proposed to be built has highly permeable, sandy soils with slopes generally less than five percent, so water run-off would be very low;
- 2) sensitive resources, like wetlands and streams and rich biological sites, are not present in the proposed area;
- 3) the trails would be sited and constructed using Department ATV trail design standards designed to minimize soil loss;
- 4) the plan calls for the trails to be closed in the spring and other wet periods when higher impacts from trail riding is most likely to occur; and
- 5) there would be regular monitoring of trail conditions and if unacceptable impacts occur trail managers would be required to either mitigate any unacceptable impacts or close the section of trail.

Negative impacts from illegal off-trail ATV riding may occur in the ATV trail area or elsewhere on the forest. Within the zone where the trails would be constructed there are no known endangered species sites or other highly sensitive resources that would be impacted. However, several sites with sensitive resources, (i.e. proposed State Natural Areas and research lakes) are located adjacent to (400 feet) from the trail development zone. At this time its unknown how near to these sites the trails would be sited.

The state natural areas are Devine Lake and Mishonagon Creek and the Camp Lake and Pines (see Appendix E: State Natural Areas for a description of these sites). Illegal ATV riding could cause significant environmental damage to these natural areas.

Camp Lake and Little Rock Lake are used by the U.W. of Wisconsin for long-term research projects. Currently, both lakes are the focus of an extensive experimental research project examining the role of dead wood along the shorelines and in shallow waters of lakes on fisheries and food webs. Because the research concerns the subtle changes in the food web, inadvertent ATV use along the shoreline or in

the water could impact the research results. Little Rock Lake has also been the site of a long-term and on-going 20 year study of mercury bio-accumulation in food webs. This is possibly the longest continuous mercury study in the world. Shoreline disturbances, especially those that stir up near-shore sediments, can increase levels of toxic mercury compounds in these lakes. The lake is closed to public access and fishing because of this research. Any increased human activity on the shore area would increase the mercury levels and confound the results of this long-term study. ATV use in the proximity of the lake would increase the potential for human disturbance on Little Rock Lake and negative impacts on the research project. (Pers. com. Dr. Tim Kratz, Center of Limnology, University of Wisconsin.)

### **SOCIO-ECONOMICS**

The addition of a ATV trail network in the area south of Camp Lake would cause an increase of noise for persons living in the area or recreating on nearby lakes, including Devine lake, a designated wild lake. There currently are no developed public recreational facilities in this area.

ATV riders currently do not have opportunities on the Forest but would gain access under the proposal to build 8-10 miles of trail. However, while ATV riders would likely bring some additional economic activity to local communities, the benefit would likely be small due to the limited length of trail proposed.

